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China Report

SCIENCE AND TECHNOLOGY

No. 145



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29 January 1982

CHINA REPORT

SCIENCE AND TECHNOLOGY

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APPLIED SCIENCES

REMOTE SENSING TECHNOLOGY FINDING WIDER APPLICATION

Beijing GUANGMING RIBAO in Chinese 30 Oct 81 p 1

[Article: "Significant Results Achieved in Various Fields Such as Geology, Agriculture, Meteorology, Water Conservation, and Environmental Surveillance From Extensive Application of Remote Sensing Technology"]

[Text] Xinhua, Beijing, October 20: Definite results have been achieved in recent years in various fields, including geology, agriculture, meteorology, water conservation and environmental surveillance, from an extended application of remote sensing technology by the various concerned departments.

Remote sensing technology is an advanced detection technology developed in the 1960's. This technology uses aircraft or satellites to carry a receiver and a transmitter capable of receiving electromagnetic waves of various wavelengths, including visible light, infrared ray and microwaves into remote space to collect and record various electromagnetic wave signals consisting of reflection of solar radiation from various objects on earth and radiation emitted by various objects on earth. The information thus collected is then analyzed by discriminating the signals of various wavelengths and subjected to picture and numerical processing to reveal various macroscopic phenomena which cannot be obtained from observations made on the ground, and thus achieving the objective of maintaining surveillance over the global environment and exploring global resources.

China's remote sensing technology has made considerable progress in recent years by the joint effort of various concerned departments including scientific research, education, industry and agriculture. Various types of remote sensing instruments and equipment have been developed and manufactured, including multispectral scanners, multispectral cameras, microwave radiometers, ground object spectrometers, and equipment used in color synthesis and density division. A large number of large-scale general purpose remote sensing experiments have also been carried out. The data gathered by remote sensing have found preliminary applications in various areas including regional geological survey, petroleum exploration, hydrology, forest survey, land usage survey, geographical surveying, and cartography.

Remote sensing technology has been employed by the concerned governmental departments in compiling a one six-millionth scale linear land structural diagram of China, one one-millionth to one two-millionth scale geological diagrams of the majority of the provinces, and a 1.5-millionth scale geological diagram of the Tibet Plateau. In hydrological engineering and geological surveys, aerial remote sensing data have

been utilized by the concerned departments in analyzing the hydrological-geological conditions of arid and semi-arid regions, in charting ancient waterways of the Quanding Plain area and in exploring the discharge outlets of subterranean rivers. These data have provided important information for locating water. In addition, remote sensing technology has also begun to find other applications: Selection of railway routes, selection of large-scale construction sites, and detection of hidden geological faults. Relatively good results have also been achieved from the application of remote sensing technology in other fields such as exploring for energy resources and mineral resources, land resources surveys, agricultural zoning, forestry surveys, meteorological research, and weather forecasting.

The concerned governmental units are jointly undertaking research and development of fundamental remote sensing theories and application methods.

9113

CSO: 4008/26

APPLIED SCIENCES

PRC CITIES READJUST SCIENTISTS, TECHNICIANS

OW131005 Beijing; XINHUA Domestic Service in Chinese 0247 GMT 13 Jan 82

[By XINHUA reporter Zhou Changnian]

[Excerpts] Beijing, 13 Jan (XINHUA)--The State Council's Bureau of scientific and technological personnel recently conducted a survey of scientific and technological forces in Changzhou, Wuxi, Xiangyang, Shashi, Siping and Dandong cities. The survey shows that in order to more effectively bring into play the role of science and technology and to meet the needs of readjusting and developing the national economy, it is necessary to actively readjust the contingent of scientists and engineers and give full play to the potential of scientific and technological personnel.

While readjusting and developing the national economy, the leading groups of Changzhou and five other cities realized that the scarcity, low standard and irrational distribution of scientific and technological personnel cannot meet the needs of readjusting the economy and developing production. To more effectively organize and bring into play the role of scientific and technological personnel in readjusting and developing the national economy, they actively promoted the exchange of personnel and information and readjusted the contingent of scientific and technological personnel. They did so in light of the actual situation in each locality and through various methods.

The methods they have taken are as follows:

1. The scientific and technological forces are organized in a reasonable manner in the course of technical transformation, while shifting the direction of production in heavy industry and transforming the military industrial enterprises to make them serve both military and civilian needs, these cities have organized the scientific and technological personnel in heavy and military industrial departments in such a way that they serve the new needs in readjusting and developing the national economy.
2. The technical forces in the various departments are deployed by listening to the recommendations from other regions, departments or trades, readjusting personnel within the departments or giving them public notice.

3. The structure of the contingent of scientific and technological personnel is readjusted by providing professional training.

The readjustment of the contingent of scientific and technological personnel has enabled some scientists and engineers who were unable to make use of their professional skills at their original posts to find more suitable jobs or to bring into fuller play their professional talents. With the readjustment, the problem of long separated couples has also been solved. The enthusiasm of the scientific and technological personnel has been raised and they have scored some outstanding achievements.

CSO: 4020/75

APPLIED SCIENCES

NATURAL SCIENTISTS HOLD CONFERENCE IN GREAT HALL

OW181756 Beijing XINHUA in English 1535 GMT 18 Jan 82

[Text] Beijing, 18 January (XINHUA)--More than 1,500 scientists from the Beijing area today gathered in the Great Hall of the People for the opening of a 3-day convention of natural scientists as part of an effort to promote China's modernization program.

The scientists, from 16 natural science branch societies of the gathering's sponsor, the Scientific and Technical Association of the People's Republic of China, convened in 12 of the Great Hall's 30 meeting rooms.

Attendance in the next two days is expected to top 3,500 people from another 44 branches, all based in Beijing.

The Great Hall of the People is the site of the National People's Congress and state political affairs. Only recently was the decision made to open it, three or four times each year, to the scientific community.

"This shows the Communist Party and the government lend great importance and support to scientific academic activities," said Mao Yisheng, a bridge-building expert.

The meeting is being held in an effort to mobilize greater scientific support for China's economic program, and to provide an opportunity for contacts between both old and young scientists and various branches of science, according to Pei Lisheng, vice-chairman of the association. He hoped scientists would select research projects according to the 10 principles for economic construction advanced by Premier Zhao Ziyang at the fourth session of the Fifth National People's Congress last year, and in keeping with China's "four modernization" drive.

Zhang Wei, vice-president of Qinghua University and vice-president of the Chinese society of civil engineering, said civil engineering research should take into account three major factors.

More than 70 percent of China's territory is rocky, mountainous area, he said. China is located in a seismically active zone. The nation has many inland rivers and a long coastal line. He suggested research into the newly-developed field of rock mechanics, anti-seismic science and water transport and conservancy. He said

more than 80 percent of the country's population is in the countryside, where there is great room for development of civil engineering. He suggested more research be done in these rural areas.

Many of those present appealed to the government to attach more importance to the role of scientists. They hoped leaders would listen to them more closely before making important decisions.

They also suggested more frequent academic exchanges among different branches of science, and quick commercialization of research results, thereby allowing scientific research and economic production to promote each other.

Many older scientists hoped younger ones would be close behind them. They said promotion of scientific and technical workers should accord with their ability and learning, not their seniority and position.

CSO: 4020/74

CHINA'S FIRST SYNCHRONIZED RADIATION EQUIPMENT NOW BEYOND PRELIMINARY STAGE

Beijing GUANGMING RIBAO in Chinese 1 Nov 81 p 1

[Article by reporter Hu Yang [5170 5017] and correspondent Si Youhe [0674 2589 0735]: "Preliminary Research, Development, and Physical Design of China's First Synchronized Radiation Equipment Completed; It Provides Powerful Measure for Basic Scientific Research and Development of Top-level Technology"]

[Text] The preliminary research, development and physical design of China's first versatile large-scale new light source--Hefei electronic synchronized radiation equipment--have been certified and approved with a ceremony held in Hefei recently. The famous nuclear physicist and the deputy minister of the Second Ministry of Machine Building, Wang Ganchang, made a special trip to Hefei to preside over the ceremony and to sign the document authenticating the test results of various items related to the preliminary research and development work.

Synchronized radiation, also known as synchronized light, is a light radiation emitted by the high energy electrons obtained by an electron synchronized accelerator. Synchronized light has many applications based on its many attributes, including strong light intensity, high brightness, broad frequency band, and stability. The Hefei synchronized radiation equipment which is being designed today will have a great impact on the future development of science and technology in China, especially in the following fields: Solid physics, atomic and molecular physics, biology, chemistry, material science, radiation measurement standard, fiber technology and optical etching technology of ultra large-scale integrated circuits. It will provide a powerful measure not only for basic scientific research but also for the development of top-level technology.

Utilization of synchronized radiation as a light source has a history of only a decade or so, but it has already caught the attention of the industrially advanced nations of the world. Construction of synchronized radiation equipment in China was included in the national science and technology development plan for the first time in 1977. In the spring of 1978, the Chinese Academy of Sciences decided to organize a synchronized radiation equipment development group with the China Science and Technology University as its core, and within a period of 3 years or so they have completed the tasks of preliminary research, development and physical design of the equipment.

The ceremony for authentication was held under the auspices of the Chinese Academy of Sciences. At the ceremony were 58 scholars representing 26 units from all over the nation, including famous scientists such as Yan Jiyi, Zhang Wenvu, Ge Tingsui, Qian Linzhai, and Yang Chengzhong. The science and technology personnel who participated in the preliminary research, development and physical design of this equipment representing the Hefei ion group, the Hefei solid physics group of the China Science and Technology University and Zhejiang University was also present at the ceremony. It was the unanimous consensus of the assembly that the physical design of Hefei Synchronized radiation equipment was rational and that the equipment had met the necessary conditions to move into the engineering stage.

Ranks of young science and technology personnel have been cultivated through the work related to this preliminary research, development and physical design of synchronized radiation equipment. A group of more than 40 science and technology personnel belonging to the Science and Technology University had an average age of only 40 years or so. Capable of carrying out independent research work today, they have become a backbone force. The average age of the four deputy group leaders who were directly in charge of the task was only 45 years.

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CSD: 4008/26

APPLIED SCIENCES

AERIAL ANTI-SUBMARINE DETECTING SYSTEMS OUTLINED

Beijing YIQI YU WEILAI [INSTRUMENTATION AND FUTURE] in Chinese No 2, 1981, pp 9-10

[Article by Xu Lun [6079 0243]: "Aerial Anti-Submarine Detecting Equipment"]

[Text] Owing to good capabilities of evading detection, submarines can impose tremendous threats on the enemies by launching surprise attacks. In particular, nuclear submarines can sustain long voyages and are capable of launching nuclear weapons over a large distance. Hence anti-submarine warfare is of great significance in strategic defense. To date, many countries have invested a considerable amount of manpower and efforts to study various anti-submarine detecting equipment and weapons. Up to now, the essential means in the defense and detection of submarines is still making use of the sonar system based on acoustic principles.

The usual water sonar system includes shore-based sonar stations, ship-carried sonar and aerial sonar. They form a stereoscopic detecting network at sea level, underwater, and in the air for close monitoring. Among the stereoscopic anti-submarine systems, the aerial system plays an important role. During World War II, the number of German submarines sunk by anti-submarine aircraft accounted for more than half the total submarine loss. Hence, after World War II the U.S. and USSR as well as other countries have all been engaged in substantial development of naval aerial forces and in the study of new types of anti-submarine planes and weapons.

Airborne Sonar

The airborne sonar refers to sonar systems mounted on anti-submarine planes. This includes both suspension sonar and towing sonar. The suspension sonar works like a dragonfly skimming the water. The aircraft hangs in the air several tens of meters above the sea level, and the sonar energy exchanger is dropped into the sea. The sonar electronic system and the indication terminals are kept in the plane; the two parts are connected through cables. After the work is done, the energy exchanger is pulled back to the plane and taken to other sites for continued work. In a towing sonar system the energy exchanger is towed slowly by a low-flying plane for continuous searching. The towing sonar is suited for cruising search whereas the suspension sonar is used most times for pinpointing the submarines.

Airborne Sonar Buoy

The airborne sonar buoy is usually carried by fixed-wing anti-submarine seaplanes or bombers. It can be used to detect or to locate the submarines. The sonar buoy sends out its detected signals about the submarine via its antenna. In this way it overcomes the effect on sound wave propagation due to the two different media--air and water. It also avoids the interference problems caused by vibrating cables and turning propellers as found in airborne sonars.

The airborne buoys include the following types:

1. All-direction Passive Buoy

This buoy does not generate signals. It only detects noise signals coming from submarines in its neighborhood. After the buoy is dropped into the water, the submarine noise received by its underwater detector is converted into voltage signals which are then amplified and transmitted through its antenna. Upon receiving and processing the buoy signal, anti-submarine aircraft can control the firing system either manually or automatically to launch an attack against the submarine. In order to search for and locate the submarine over a large area, a number of buoys can be used simultaneously. In accordance with the conditions present, various forms of "arrays" can be arranged. There could be triangular, circular, square, or comb-shaped arrays of buoys.

2. Fixed-direction Sonar Buoy

This is an airborne buoy which can be used to detect the direction of a submarine. The potential energy released by the gravitational motor is converted into kinetic energy which is utilized to turn a directional sensor. During the process of turning the sensor around, a gyro coder can be used to code the directions into numbers. Each code then represents a certain direction. For instance, if a 9 bit code is used, there are 512 different states, and each state represents an angular direction of 0.7° . Once the fixed direction buoy is dropped into the water, the gravitational motor descends and it turns the sensor. If the sensor detects a submarine noise in a certain direction, it sends out a frequency modulated UHF signal which is to be received and processed by a special receiver in an aircraft and from which the direction of submarine with respect to the buoy can be determined.

3. Explosive Sound Buoy

It can be used either to detect submarine noise passively or to release an explosive sound so that the direction as well as distance of the submarine can be determined. This explosive sound source can either be carried by the buoy or be separated from the buoy and dropped into the water when there is an active need to determine the submarine distance. This kind of buoy can maintain normal function even in the presence of strong jamming.

4. Anchored Buoy

This is a large size sonar buoy, which can have either an active or a passive function. It is fixed by anchor chains in the water. This buoy is normally

used to supplement shore-based sonar stations for monitoring submarines in a certain specific water region.

5. Temperature-Depth Buoy

This is used specifically for measuring the temperature profile. The velocity of sound wave propagation in sea water is mainly affected by the temperature. On-site measurements of the temperature profile would help improve the detection accuracy and it is closely related to the precision of attacking targets. Dyes can be carried in the buoy and dissolved into sea water after the buoy is dropped, thereby causing the water to show a pink color around the buoy. Some buoys are equipped with signal lights for identification at night.

Non-Sonar Detection Systems

1. Magnetic Detectors

This method of detecting submarines makes use of the fact that the local earth magnetic field changes due to the presence of a submarine in the water. Because the magnetic field intensity decreases as the cube of the distance from the source, the sensor should be suspended in the air in order to improve the effect on distance determination. Normally the aircraft carrying such a sensor should be flying at an altitude less than 50 meters. The magnetic detector can only determine the presence of a submarine but cannot supply information about the direction, distance and velocity, etc. Advanced magnetic detectors can detect submarines at a distance around 300 meters.

2. Infrared Detectors

When a submarine is moving under the water, the temperature of its surrounding will change as a result of water drainage from the submarine or friction between its body and water. This minute temperature change can be detected by infrared from which the presence of submarine can be ascertained.

3. Low-visibility TV

This is a TV which is used for viewing targets under low visibility conditions. It is primarily used at night. Submarines, after prolonged underwater voyages, need to raise ventilation pipes above the water to "breathe." This is usually done at night. Anti-submarine planes equipped with low-visibility TV cruising at night can detect such a submarine when it is taking a "breath."

Anti-submarine cruising planes can be equipped with other anti-submarine devices in addition to the systems described above, such as radar in the front compartment, etc. Following the advances in science and technology and the needs in exploring resources in the sea, improvements and developments in anti-submarine planes, detecting systems and weapons are being made continuously. These are important steps in the defense of national security, resources and economic construction.

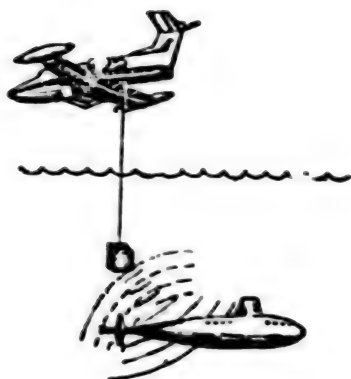


Fig. 1 Submarine detection by suspension sonar

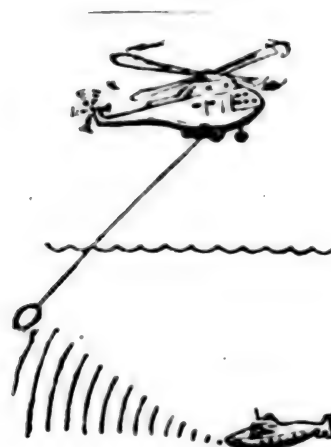


Fig. 2 Submarine detection by towing sonar

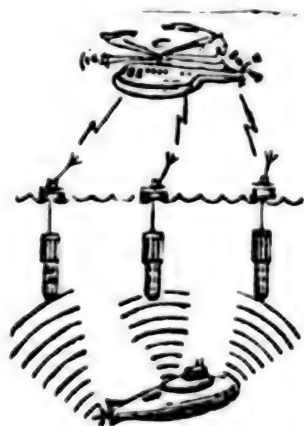


Fig. 3 Submarine detection by sonar buoy

[Illustrations by Wang Jiming [3769 4949 2494]]

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CSO: 4008/22

APPLIED SCIENCES

INSPECTION OF AIRCRAFT ENGINE BLADES MODERNIZED

Beijing YIQI YU WEILAI [INSTRUMENTATION AND FUTURE] in Chinese No. 2, 1981: 17

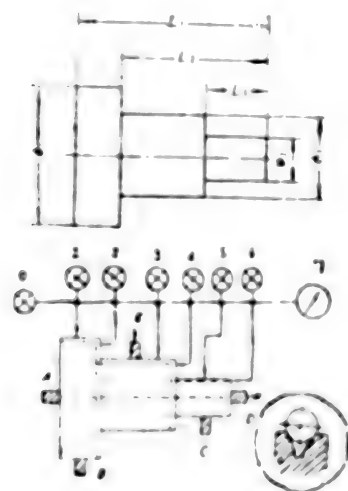
[Article by Tao BaoXiang [7118 0202 4382]: "Inspection of Aircraft Engine Blades"]

[Text] In the fall of 1967, an aircraft parked in a certain airport was all set for its special mission flight. The pilot entered the cockpit with full confidence, started the engine, and was awaiting the order to take off and zoom his iron eagle into the sky like an arrow. All of a sudden, the pilot detected that the engine sounded different. From his extensive experience, he realized that it was a serious problem and immediately asked the command center to stop the flight for an inspection. Before he could even finish the conversation, he heard a high-pitched sound. The engine had come to a complete stop. Luckily, this incident had occurred prior to the takeoff, otherwise the consequences could have been unthinkable.

After inspection, it was discovered that because the engine blades had exceeded the size tolerance by 0.2 mm., this resulted in a too small radius of curvature which caused a concentrated stress and the parts which could not withstand the working condition with dynamic load under high temperature and high pressure were ruptured. During high speed spinning, the fragments had destroyed the whole blade assembly and its surrounding components. Accidents of this kind--which have resulted in serious damages, wrecking planes and costing lives--are not rare in the history of aviation. Therefore, it is essential to place high standards and strict requirements on the inspection of engine blades.

For a long time, we have been following the inspection method used in the 1950's. This old method makes use of special templates, calipers, and percentage tables, etc. It not only has a low efficiency, which requires more work, but also the results are of low reliability. Recently, our country succeeded in developing a new instrument for inspecting the blades--it is called the Inductive Inspection Device (IID). It can perform in a single operation a complete inspection of many parameters, such as the blade thickness, curvature, perpendicularity, and the degree of parallelism. It can be used primarily for terminal inspection of blade parts or miscellaneous components in the intermediate stage. This device has a high efficiency, shows reliable quality of inspection, is easy to maintain, and offers a wide applicability. The IID makes use of an inductive

1. Inductive Inspection Device (IID) which converts a mechanical displacement into an electrical signal. This device is based on the principle of comparative measurement. In this method a "standard part" (or a qualified part) is first placed in a mechanical setup which fixes its position with a high degree of precision. A signal is then produced at the output of the device via the inductive displacement transducer. The signal is adjusted so that if the size of the measured part is within the tolerance limit, the output will give a pass signal; if the size is out of the tolerance limit, the output will give a fail signal. After this adjustment, the part that has been examined will be placed in the mechanical setup and the signal output indicator light of the device will reveal whether this part is up to standard or not. In the past, to inspect the compressor blades in a certain aircraft engine, six persons, five sets of special and general-purpose measuring tools were needed. With the IID, only one person is needed to carry out a reliable inspection. A sewing machine factory has made use of the IID to inspect the surface of parallelism and perpendicularity of the bore in the sewing head. This has brought about an increased work efficiency of more than tenfold and improved quality of products. The application of IID in our country has just started. Following the developments in industrial and agricultural production and national defense construction, it will play an increasingly important role in these aspects.



Schematic Diagram Showing the Structure of Inductive Inspection Device

A: workpiece fixing position; B,C: V-shaped fixer; D,E: movable pressor;
 1-6: indicator lights corresponding to displacement
 7: readout meter

Author: Wang Jiming [3769 4949 2494]

APPLIED SCIENCES

BRIEFS

ZHEJIANG WEATHER STATION--The first 713-mode radar weather station in Zhejiang built by the Central Meteorological Bureau was recently completed in Dinghai County. This is one of the radar weather stations in China which has fairly advanced technology and equipment. It is designed to safeguard the industrial and agricultural production in east China, especially the Zhoushan Islands area, and to meet national defense construction needs. With its numerous functions and the ability to forecast weather within a radius of 6,000 km, it can precisely predict thunderstorms, typhoons and other disastrous weather conditions.
[Hangzhou Zhejiang Provincial Service in Mandarin 1040 GMT 20 Dec 81 FW]

CSO: 4008/62

AUTHOR: WU Boxiu [0702 0130 0208]

ORG: China Institute of Communications

TITLE: "The Power Spectrum Analysis of an M-channel ΔM PSK Signal and Its Application in the Determination of the Main Specifications of a Directional-filter Duplexer"

SOURCE: Beijing TONGXIN XUEBAO [JOURNAL OF CHINA INSTITUTE OF COMMUNICATIONS] in Chinese No 4, 1981 pp 1-11

TEXT OF ENGLISH ABSTRACT: In this paper we derive a high frequency power spectrum equation of the multiplex ΔM PSK double-polarity signal by means of a statistical method. Based on this equation, a method for the determination of the main specifications of a directional-filter duplexer used in a M.W. relay communication system is explored. A program for the calculation, with the aid of a programmable calculator TI-59, of the power spectrum of this kind of signal is given. The selectivity and VSWR curves of an experimental duplexer, designed according to the specifications obtained by this method and used successfully in an all integrated and all building-block construction 1 GHz relay communication system, are also given.

AUTHOR: HU Yun [5170 4596]

CHAI Qinglian [2693 3237 3425]

ORG: Both of the China Institute of Communications

TITLE: "The Optimum Sequence of Cascading Elliptic Active Bandpass Filters"

SOURCE: Beijing TONGXIN XUEBAO [JOURNAL OF CHINA INSTITUTE OF COMMUNICATIONS] in Chinese No 4, 1981 pp 12-22

TEXT OF ENGLISH ABSTRACT: In the cascade realization of active filters, the selection of the sequence of cascading is based on the principle of largest dynamic range and highest signal to noise ratio, with regard also to some other effects. The presently existing method for determination of the optimum sequence requires cumbersome calculations, the labor of which would be heavier for higher order functions. Some simple methods have been suggested, but the results were not very successful. This paper is concerned with the elliptic type bandpass (which is most popularly used for higher technical requirements) and it presents a new method for determining the optimum sequence of cascading which is simple and versatile. Through practical examples we show the foundation for this method.

AUTHOR: BAI Qizhang [4101 0366 4545]

ORG: China Institute of Communications

TITLE: "On the Relation between Walsh Functions and the Transposition Patterns of Open-wire Telecommunication Lines"

SOURCE: Beijing TONGXIN XUEBAO [JOURNAL OF CHINA INSTITUTE OF COMMUNICATIONS] in Chinese No 4, 1981 pp 23-32

TEXT OF ENGLISH ABSTRACT: Since open-wire lines still occupy a very large proportion of long-distance equipment in China, "transposition of conductors" is still the most important technical means in the field of telecommunication transmission lines. This paper deals with the applications of Walsh functions in transposition patterns of open-wire lines and shows that the "letter type" patterns are in correspondence with Walsh functions ordered by sequence ordering, while the "index type" patterns are in correspondence with Walsh functions ordered by Hadamard matrices ordering. In this paper, the fundamental properties of the simple index types, the complex-index types, the symmetry of patterns and the relative types are discussed according to Walsh function's characteristics.

AUTHOR: FAN Changxin [2868 2490 0207]

ORG: China Institute of Communications

TITLE: "On Even Channel Majority Multiplexing"

SOURCE: Beijing TONGXIN XUEBAO [JOURNAL OF CHINA INSTITUTE OF COMMUNICATIONS] in Chinese No 4, 1981 pp 33-42

TEXT OF ENGLISH ABSTRACT: The adaptive majority multiplexing method of using truncated Walsh functions as carrier code has been suggested for several years. However, the performance of even active channels in this method has not yet been investigated sufficiently. In this paper, the principle and performance of even active channels are discussed, the existence of two majority decision criteria which are equivalent and practical is proved and the corresponding appropriate carrier code sets are found. In addition, the cause of errors that may appear at just five working channels is explained.

AUTHOR: GAO Guangming [7559 1639 2494]

ORG: China Institute of Communications

TITLE: "Plesiochronous/synchronous Multiplex Technique Using Positive/zero/negative Justification"

SOURCE: Beijing TONGXIN XUEBAO [JOURNAL OF CHINA INSTITUTE OF COMMUNICATIONS]
in Chinese No 4, 1981 pp 60-65

TEXT OF ENGLISH ABSTRACT: In this paper, we present the general principles and the frame structure design of the digital multiplex using positive/zero/negative justification, and analyze the characteristic of stuffing jitter. The engineering applications of this technique have also been discussed briefly.

AUTHOR: ZHANG Yanqin [1728 3508 2953]

ORG: China Institute of Communications

TITLE: "An Economical Clock Generator--Single Resistor Crystal Oscillator"

SOURCE: Beijing TONGXIN XUEBAO [JOURNAL OF CHINA INSTITUTE OF COMMUNICATIONS]
in Chinese No 4, 1981 pp 66-72

TEXT OF ENGLISH ABSTRACT: Following the design ideas of linearization of the gate circuits, we have, in this paper, proposed an economical and stable higher frequency crystal oscillator made up of TTL NAND gates, and derived a mathematical formula relating the highest oscillating frequency of the oscillator with the average delay time of the TTL gates used in the circuit. The test data of the oscillator at 8.448 MHz (the clock frequency of secondary group PCM) are also given.

AUTHOR: YE Peida [5509 1014 1129]
LIN Jirong [2621 6855 2717]

ORG: Both of the China Institute of Communications

TITLE: "Modal Noise in Optical Fiber Communication System"

SOURCE: Beijing TONGXIN XUEBAO [JOURNAL OF CHINA INSTITUTE OF COMMUNICATIONS]
in Chinese No 4, 1981 pp 80-86

TEXT OF ENGLISH ABSTRACT: Modal noise is a newly discovered phenomenon which, under certain circumstances, may seriously degrade the performance of digital and particularly analog, communication systems. It appears as parasitic amplitude modulation and is extremely sensitive to physical distortion of fiber between the first connector of the system. It is a function of coherence of light source, spatial or modal filtering and transmission characteristics of fiber. This paper reviews the principle, analysis and effects of modal noise. Several methods for reducing modal noise are presented. Finally, the problems needing further investigation are discussed briefly.

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CSO: 4009/199

AUTHOR: Wu Yingwen [0205 7686 0937]

ORG: Test Lab Laboratory, North China Electric Power Design Institute

TITLE: "Performance of Polyphase Ground Distance Relay: Its Analysis and Digital Computation"

SOURCE: Nanjing DIANLI XITONG ZIDONGHUA [AUTOMATION OF ELECTRIC POWER SYSTEMS]
IN Chinese No 5, 1981 pp 16-38

TEXT OF ENGLISH ABSTRACT: A ground distance relay, operating on the principle of phase comparison of three-phase compensated voltages and zero sequence current and allowing larger grounding resistance, is more appropriate for short line ground fault protection than is the MHO relay. This paper analyzes the performance of this type of relay in the case of ground faults, especially its directional feature, operation during power swing, phase shift influence of zero sequence infeed current and the effect of arc resistance between faulty phases. The conclusion of analysis is checked with the calculation results of a digital computer.

AUTHOR: Wu Yingwen [0702 2019 2429]
Gao Jianye [6753 1696 2814]

ORG: Bureau of the Changban Electromechanical Office

TITLE: "Electrical Coordination of Electro-hydraulic Governor for a Kaplan Turbine"

SOURCE: Nanjing DIANLI XITONG ZIDONGHUA [AUTOMATION OF ELECTRIC POWER SYSTEMS]
IN Chinese No 5, 1981 pp 51-60

TEXT OF ENGLISH ABSTRACT: In order to keep efficient operation of a Kaplan turbine, it is necessary to adjust both the guide vane opening and the blade angle under different load heights by the governor. At present, instead of a cam mechanism, hydraulic coordination devices are adopted in simultaneous adjustment of guide vanes and blades.

In this paper, an electrical coordination device, first developed in China, is introduced. Two types of bivariate function generators are explained in detail.

AUTHOR: YI Shugen [2496 2885 2704]

ORG: Equipment Integration and Design Institute, Harbin Power Station

TITLE: "Input Circuit and Anti-interference Measures of A-D-A Type Digital Frequency Discriminator"

SOURCE: Nanjing DIANLI XITONG ZIDONGHUA [AUTOMATION OF ELECTRIC POWER SYSTEMS] in Chinese No 6, 1981 pp 61-69

TEXT OF ENGLISH ABSTRACT: This paper describes the input circuit and anti-interference measures of the A-D-A type digital frequency discriminator used in the speed governing system of hydraulic turbines.

In the first part of the paper, a current composite connection for simplifying the main equipment circuitry and the design of an input filter are introduced. In the second part, after a brief analysis of the interference characteristic in the speed governing system of hydraulic turbines, effective measures for resisting interference are proposed.

AUTHOR: LIU Kaizeng [0491 7030 1073]

ORG: None

TITLE: "PCM Multiplex Terminal Equipment for Digital Fiber-optic Communication"

SOURCE: Nanjing DIANLI XITONG ZIDONGHUA [AUTOMATION OF ELECTRIC POWER SYSTEMS] in Chinese No 6, 1981 pp 77-82

TEXT OF ENGLISH ABSTRACT: This paper gives a brief description of the design principles of a PCM multiplex terminal for fiber-optic communication, namely, speech channel, timing, synchronization, coding-decoding and format.

7717

CSO: 4009/193

Iron and Steel

AUTHOR: MING Zhicheng [2494 1807 3397]

ORG: Shanghai Steel Works No 5

TITLE: "Some Preliminary Experiences with TQC"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 11, Nov 81 pp 6-11

TEXT OF ENGLISH ABSTRACT: TQC has been introduced and practiced for two years in the Shanghai Steel Works No 5. Some results have been achieved. This paper describes six aspects regarding the practice and experience of the application of TQC.

In order to implement the overall application of TQC in the plant, realization of the following aspects is a prerequisite for success:

1. A comprehensive understanding of the leadership of the TQC potentials.
2. Special attention to fundamental work.
3. Promotion of the activities of the TQC working group.
4. Assurance of a good feedback for quality information.
5. The technical personnel should be the backbone in carrying out the TQC work.
6. A rigid system of rewards and penalties applicable to all employees.

AUTHOR: XU Wenyong [1776 2429 2589]

ORG: Steel Works No 1, Benxi Iron and Steel Company

TITLE: "How to Improve the Quality of Rolled Products by Removing Defects"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 11, Nov 81 pp 12-17

TEXT OF ENGLISH ABSTRACT: This paper describes how to apply TQC as a basic means in production practice in analyzing and solving the key problems influencing the quality of rolled products by the QC group of our 38-rolling mill (rolls with 300 mm diameter and 800 mm length). During the PDCA cycle, special techniques were applied to the QC group activity to sum up and to work out the standard processes, and to devise successfully two "computing graphs for standard operation" for round, square and hexagonal bars and various sizes of flats. The integration and popularization of process technology were carried out from theory and practice, with the result that the quality of products and the output of the mill were improved. A new way has been opened to make the most of the old mills and to lead to the standardization of rolling practice for producing multi-products from a certain mill.

AUTHOR: TANG Qiwen [0781 0796 2429]

ORG: Qiqihar Steel Works

TITLE: "TQC Improves Product Quality"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 11, Nov 81 pp 18-24

TEXT OF ENGLISH ABSTRACT: The Qiqihar Steel Works has been gradually establishing a quality-guarantee system in the fields of administration, major products and production procedure since the application of TQC. They have adopted different types of control graphs for main procedures and have begun to use the regressive probability tables for dynamic quality control of some grades. This enables the steelmakers to control the steel composition from the point of guaranteeing the steel properties instead of simply meeting the required composition, and further, to control the best combination of several elements instead of controlling them individually. All these can be used for correcting the rules of operation issued by the Works.

Based on the study of the situation of the product quality, new technologies and processes have been adopted to raise the output, and the production lines for eight different products have been installed for enlarging the product varieties.

AUTHOR: WU Huiran [0702 1920 3544]

ORG: Dalian Steel Works

TITLE: "Apply PDCA Cycle to Improve the Phosphorizing Quality of Spring Wire"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 11, Nov 81 pp 25-29

TEXT OF ENGLISH ABSTRACT: By practicing PDCA cycle, the wire phosphorizing QC group in Dalian Steel Works has improved the phosphorizing process. Problems which existed before, such as over-thin phosphorizing film, color change of solution, too much impurity precipitation and moisture absorption of bauxite, etc., have been solved, thus the quality of phosphorizing coating is enhanced progressively and the phosphorizing process suitable for cold drawing of high strength spring wire is worked out.

By adopting the phosphorizing treatment the lubrication condition is improved, so that the rate of drawing can be increased, the equipment efficiency may be brought into play and good economic effects are achieved.

AUTHOR: ZOU Hengyan [6760 1854 6056]
LIU Daodi [0491 6670 4574]
WANG Guoqiang [3769 0948 1730]

ORG: All of Chongqing Special Steel Works

TITLE: "Study of the Origin and Mechanism of Formation of the Globular Inclusions in GCr15 Bearing Steel"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 11, Nov 81 pp 30-38

TEXT OF ENGLISH ABSTRACT: The origin and mechanism of the formation of globular inclusions in GCr15 bearing steel and factors affecting their formation have been investigated. It has been shown that such inclusions can occur indigenously and grow to 50-60 μm during liquid steel solidification process. Keeping the oxygen content of liquid steel as low as possible, decreasing the amount of calcium and properly increasing the residual aluminum in steel will enable the calcium aluminates formed by deoxidation products to be predominantly turned into the $\text{CaO} \cdot 6\text{Al}_2\text{O}_3$ type. This will be conducive to preventing the formation of globular inclusions in steel.

It appears that the coarse globular inclusion formation would be scarce in the case that $\text{O}_2 < 25 \text{ ppm}$, $\text{Ca} < 14 \text{ ppm}$ and $\text{Al} > 400 \text{ ppm}$ in bearing steel produced in an electric furnace.

AUTHOR: XU Minghua [1776 2494 5478]
SHEN Shunde [3088 7311 1795]

ORG: Both of Shanghai Steel Works No 5

TITLE: "An Investigation of Globular Inclusions in Bearing Steel"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 11, Nov 81 pp 39-44

TEXT OF ENGLISH ABSTRACT: The essential globular inclusion in bearing steel smelted with white slag process in an electric furnace is an oxide of Al and Ca and a small amount of Mg. This paper describes the forming mechanism of coarse globular inclusions through the agency of the radioisotope Ca^{45} as a "tracer." It is concluded that these inclusions are formed on the emulsified slag drip not removed during tapping. This paper shows the reason for the analysis difference between the coarse globular inclusions in the product and slag during tapping. The relationship between the amount of inclusions coming from mixed slag (\hat{Y}) and time (X) follows the formula $\hat{Y} = \text{De}^{c/x}$. Some process factors, such as oxidation and effervescence of steel, composition of reducing slag, desulfurizing efficiency and killed time, etc., must be controlled to improve and stabilize the quality of bearing steel. Utilization of a headbox is beneficial to diminishing the number of inclusions in the ingot head.

AUTHOR: HU Debin [5170 1795 2430]
WANG Jihuo [3769 0679 0735]
ZHANG Jimeng [1728 4949 3718]

ORG: All of the Taiyuan Iron and Steel Company

TITLE: "Quality Analysis of 2Cr13 Cold Rolled Sheet"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 11, Nov 81 pp 45-48

TEXT OF ENGLISH ABSTRACT: Using Fe-Si deoxidation, controlling annealing temperature and strengthening shot blast descaling in continuous annealing line, the quality of 2Cr13 cold rolled sheet is improved considerably. The corrosion resistance is raised, no rust pits are found by 3 percent NaCl spraying test after 48 hours. The plasticity and formability of products are enhanced. The elongation of all specimens is over 30 percent, and 86.15 percent of them showed elongation larger than 40 percent. Therefore, the needs of users have been satisfied.

AUTHOR: WANG Shengxuan [3769 5116 1357]

ORG: Daye Steel Works

TITLE: "Metallurgical Effect Obtained by RH Vacuum Degassing Process"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 11, Nov 81 pp 49-55

TEXT OF ENGLISH ABSTRACT: Over 1300 heats treated with the RH device show that this equipment has the advantages of convenience in operation and obvious degassing effect. Based on a large number of productive data, the metallurgical effect obtained by the vacuum degassing process is confirmed and a rational selection of process parameters is analyzed in combination with working conditions.

Open hearth plus vacuum degassing or open hearth-electric furnace duplex plus vacuum degassing has been a feature of producing special steel at Daye Steel Works.

AUTHOR: ZHANG Yutian [1728 3768 3944]

ORG: Xining Steel Works

TITLE: "Contrast Analysis of Cold Drawing Bearing Steel Produced Domestically and Abroad"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 11, Nov 81 pp 56-61

TEXT OF ENGLISH ABSTRACT: In addition to results retested by Luoyang Bearing Plant for cold drawing bearing steel produced domestically and abroad, some imported materials are also examined. Based on the data obtained, mathematical statistics and contrast analysis have been carried out and important differences between domestic and foreign materials have been discovered. The productive process of domestic bearing steel is also compared with that of some foreign countries.

It is pointed out that refining equipment and continuous annealing furnace with controlled atmosphere must be constructed quickly in order to solve problems of inclusion and structure respectively. It should lay stress on research on the ingot mode and rational processes so as to improve the carbide grade. It is believed that, in doing this, the quality of domestic bearing steel will catch up with advanced levels of foreign steel in a short time.

AUTHOR: LI Lisheng [2621 7787 5116]
ZHOU Xiaonong [0719 0876 6593]
DENG Yukun [6772 3768 2492]
WANG Shizhang [3769 0013 4545]
LI Yaoqing [2621 5069 0615]

ORG: LI Lisheng, ZHOU and DENG all of Dalian Steel Works; WANG and LI Yaoqing both of the Central Iron and Steel Research Institute

TITLE: "The Progress of High-speed Tool Steel Production in China"

SOURCE: Beijing GANGTIE [IRON AND STEEL] in Chinese No 11, Nov 81 pp 62-69

TEXT OF ENGLISH ABSTRACT: China has been one of the largest high-speed tool steel producing countries in the world. Her high-speed steel series, steel products available, quality level achieved and scientific research progress are concisely described. Since China possesses a superior position in natural resources of valuable elements, such as W, Mo and V, and an ability for lower cost production of high quality products of various forms and grades, it is suggested that, in addition to fully satisfying the domestic demands, a large export of high-speed steel products and tools should be encouraged in order to earn more foreign currency for the Four Modernizations.

9717

CSO: 4009/196

AUTHOR: ZHANG Qixian [1728 0796 0341]

ORG: Beijing Institute of Aeronautics and Astronautics

TITLE: "Force Analysis of Single-loop Spatial Mechanisms by means of One Free Pair Element"

SOURCE: Beijing JIXIE GONGCHENG XUEBAO [CHINESE JOURNAL OF MECHANICAL ENGINEERING] in Chinese No 4, 1981 pp 1-10

TEXT OF ENGLISH ABSTRACT: Differing from the traditional method of force analysis of spatial mechanisms, this paper suggests a method of force analysis by means of the first determination of the reaction acting at one kinematic pair. This reaction is always statically determined for ordinally constrained mechanisms. In this paper the process of determination via matrices is given in detail. The four-link RCCC and five-link RRSRR mechanisms are analyzed as examples. For RCCC mechanism the determination of other reactions acting at the remaining pairs and the determination of balancing force acting on the input or output link are given as well. This method of force analysis can be applied to any arbitrary complex spatial mechanism.

AUTHOR: LAI Qian [0171 5709]

ORG: Xi'an Jiaotong University

TITLE: "The Design of Cam Profiles from Arbitrarily Prescribed Acceleration Curves"

SOURCE: Beijing JIXIE GONGCHENG XUEBAO [CHINESE JOURNAL OF MECHANICAL ENGINEERING] in Chinese No 4, 1981 pp 11-16

TEXT OF ENGLISH ABSTRACT: The design procedure described in this paper consists of:

1. Selection of a virtual acceleration curve represented by a series of numerical values (a mm) with arbitrarily prescribed shape according to working requirements of the cam follower;
2. Selection of incremental cam angle ($\Delta\theta$) according to the desired and attainable accuracy of contour fabrication;
3. Adjustment of the above virtual curve so that it will satisfy certain given requirements or boundary conditions of the follower during its stroke. Various follower boundary conditions are grouped into four classes. For each class an equation for adjustment is derived;
4. Calculation of the unknown scale factor μ_a mm/s²/mm (actual acceleration A in mm/s² = $\mu_a a$) and the required cam profile by substituting in a set of equations derived for each class of boundary conditions.

A historical review of this topic and an example for approving design formulas are placed at the beginning and end of this paper.

AUTHOR: XU Damao [1776 1129 2021]

ORG: Research Office, Harbin Steam Turbine Plant

TITLE: "Specific Enthalpy Difference and Its Application in Aerothermodynamic Calculations"

SOURCE: Beijing JIXIE GONGCHENG XUEBAO [CHINESE JOURNAL OF MECHANICAL ENGINEERING] in Chinese No 4, 1981 pp 17-30

TEXT OF ENGLISH ABSTRACT: In this paper a new method of aerothermodynamic calculation for gas turbines and air-breathing jet engines is offered. The main contents of this method are:

(1) Introducing a new thermodynamic parameter called specific enthalpy difference, a series of charts are established for calculating isentropic process of combustion gases produced from fuel CH_2 , so that the calculations can be simplified with sufficient accuracy.

(2) After analyzing combustion gases produced from fuel " CH_n " and " $\text{CH}_n\text{O}_m\text{N}_p$," correction methods for calculating their thermodynamic properties have been found.

(3) In order to use computers in the above calculations, analytical formulas with an accuracy of about 0.15 percent are provided.

AUTHOR: LI Lijun [2621 0500 6874]
FU Jiecai [0102 2638 2088]

ORG: Both of Hunan University

TITLE: "A Study of Grinding Force Mathematical Model"

SOURCE: Beijing JIXIE GONGCHENG XUEBAO [CHINESE JOURNAL OF MECHANICAL ENGINEERING] in Chinese No 4, 1981 pp 31-41

TEXT OF ENGLISH ABSTRACT: Grinding forces are composed of chip formation forces and friction forces. Based on this concept, we obtain a new grinding force model. It is composed of two terms corresponding to chip formation forces and friction forces respectively.

Relationships between grinding forces and grinding parameters with workpieces of different materials are determined experimentally. The results indicate a close agreement with the model proposed.

We have also analyzed the ratio between tangential forces and normal forces with respect to both chip formation forces and friction forces. The ratio generally falls within the range of 0.2 ~ 0.59. When workpieces of different materials are ground, the measured values of the ratio are within this range.

Based on the grinding force model obtained, problems such as the significance of equivalent chip thickness and the effect of high speed grinding are discussed.

AUTHOR: CHEN Wanji [7115 8001 0679]

ORG: Engineering Mechanics Research Institute, Dalian Institute of Technology

TITLE: "A New Method for Analysis of Elastic Contact Problems Using Finite Element Methods"

SOURCE: Beijing JIXIE GONGCHENG XUEBAO [CHINESE JOURNAL OF MECHANICAL ENGINEERING] in Chinese No 4, 1981 pp 42-54

TEXT OF ENGLISH ABSTRACT: This paper deals with elastic contact problems belonging to the category of boundary condition nonlinearity with small deformation. The nonlinearity of elastic contact problems is due to the contact conditions at the points contacted.

The mixed approach suggested by this paper is suited for solving the local nonlinear problems. The general ideas of this mixed approach using FEM are as follows: after the discretization of elastic bodies, according to the displacement field assumed, we can get the stiffness matrix of elastic bodies, thus the matrix of influence coefficients of contact stress at the contacting boundaries can be determined. In addition, regarding the contact stresses as unknown variables, the compatibility conditions at contact boundaries then are given. As a matter of fact, we thus performed a procedure which localized the nonlinearity of the problem.

[Continuation of JIXIE GONGCHENG XUEBAO No 4, 1981 pp 42-54]

The computational results show that in solving such a class of problems with complex nonlinear boundary conditions by means of this method, the computational speed and storage are slightly greater or approach those from solving general linear problems.

AUTHOR: ZHUANG Fengling [8369 7364 7881]

ORG: Automation Research Institute, Ministry of Metallurgy Industry

TITLE: "Experimental and Theoretical Studies of the Hydraulic Screwdown System of Rolling Mills"

SOURCE: Beijing JIXIE GONGCHENG XUEBAO [CHINESE JOURNAL OF MECHANICAL ENGINEERING] in Chinese No 4, 1981 pp 55-64

TEXT OF ENGLISH ABSTRACT: Some factors which have an effect on the frequency response of the hydraulic screwdown system are studied theoretically by the experimental investigation. This paper presents methods to increase the frequency band. It includes flow compensation, double servo valve control, proper selection of the hydraulic cylinder area, increasing the supply pressure of the oil source, and using the servo valve with high rated flow and wide frequency band. An experimental set-up is introduced, and the measurement of friction force for a large-scale hydraulic cylinder and its measured results are presented for the first time in published literature.

When the input signal to the control system is of $100 \mu(p-p)$, the frequency band that may be obtained for this experimental system is 13 Hz, and the screwdown velocity reaches 4 mm/s. The diameter of the hydraulic cylinder is 1000 mm.

AUTHOR: JIANG Jinliang [5592 6930 5328]

ORG: Fudan University

TITLE: "Numerical Computation of the Viscous Incompressible Axisymmetrical Flow in Turbomachinery"

SOURCE: Beijing JIXIE GONGCHENG XUEBAO [CHINESE JOURNAL OF MECHANICAL ENGINEERING] in Chinese No 4, 1981 pp 65-73

TEXT OF ENGLISH ABSTRACT: This paper presents a numerical method for computing the viscous incompressible steady laminar flows in turbomachinery. The fundamental equations governing the viscous incompressible flows in the rotating coordinate system are obtained. The numerical solution is obtained by iterative computation of the pressure gradient equation which is satisfied in the direction of an arbitrary curved line. The computational method and steps are described in detail and the numerical computation is made for some channels. The computational results show that the present method is simpler and available.

AUTHOR: ZHU Hengsheng [2612 1854 3932]

ORG: Dalian Railway College

TITLE: "The Engagement of Cycloidal Gear and the Point-tooth Replacement Method"

SOURCE: Beijing JIXIE GONGCHENG XUEBAO [CHINESE JOURNAL OF MECHANICAL ENGINEERING] in Chinese No 4, 1981 pp 74-80

TEXT OF ENGLISH ABSTRACT: Based on the investigation of the design calculations used for various kinds of gears in mesh, a concept has been proposed by the author that the cycloid can be replaced by an engaged point-(or cylindrical) tooth, i.e., by using a point-(or cylindrical) tooth located on the surface and on the line of action of the conjugated gear to replace the original cycloidal gear, so that the engagement of the cycloidal curve is replaced by the engagement of a point-(or cylindrical) tooth, and then one can proceed with the calculation. This is a new method and is much simpler than the various kinds of calculations presently used.

AUTHOR: CHEN Weirong [7115 1919 2837]

ORG: Shandong Mining College

TITLE: "Theory of Conjugate Surfaces Having Two Degrees of Freedom and Its Application"

SOURCE: Beijing JIXIE GONGCHENG XUEBAO [CHINESE JOURNAL OF MECHANICAL ENGINEERING] in Chinese No 4, 1981 pp 81-93

TEXT OF ENGLISH ABSTRACT: In this paper, the author deduces the formulas of curvature of conjugate surfaces having two degrees of freedom by applying the method and mathematical tool used in his paper "Analytical Theory of Space Meshing." The conditions of curvature interference and degeneration of these surfaces are also obtained.

A systematic discussion is made of the theory of hobbing and shaving of spur and helical gears. The author deduces an approximate formula to evaluate the profile errors between the works cut with the hob and corresponding rack-type cutter, etc. As the examples of practical application, the cases of hobbing of spur and helical gears with either involute hob or Archimedian hob are discussed.

AUTHOR: ZHENG Shibiao [6774 2514 1753]

ORG: Fuzhou Power Machinery Plant

TITLE: "Introducing Two Typical Micro-small Motivating Heads"

SOURCE: Beijing JIXIE GONGCHENG XUEBAO [CHINESE JOURNAL OF MECHANICAL ENGINEERING]
in Chinese No 4, 1981 pp 94-97

TEXT OF ENGLISH ABSTRACT: All kinds of motivating heads are the important foundation parts with automation for the machine building industry. This article introduces the constructional principles and the application examples of two typical hydraulic and air-hydraulic micro-small motivating heads with major shaft skidded lenses.

9717

CSO: 4009/189

AUTHOR: WU Wangyi [0702 2598 0001]
CHEN Lilian [7115 4539 5571]

ORG: Both of Beijing University

TITLE: "The Problem of Fluid Displacement in Porous Media under High Production Rate and Its Application in Naturally Fractured Reservoirs with Vugs"

SOURCE: Beijing LIXUE XUEBAO [ACTA MECHANICA SINICA] in Chinese No 6, 1981
pp 529-537

TEXT OF ENGLISH ABSTRACT: This paper adopts a double-porosity model and nonlinear two-term law of flow in porous media. For one-dimensional flow, the basic equations of two-phase displacement in cavernous-fractured reservoirs are derived, then solved numerically by using the characteristic method. After comparing it with linear results, essential characters of nonlinear effects and oil displacement by water from naturally cavernous-fractured reservoirs have been revealed and clarified.

AUTHOR: SHEN Qing [3088 7230]

ORG: Institute of Mechanics, Chinese Academy of Sciences

TITLE: "Slightly Rarefied Gas Flow over a Sphere under Maxwell-type Boundary Conditions"

SOURCE: Beijing LIXUE XUEBAO [ACTA MECHANICA SINICA] in Chinese No 6, 1981
pp 538-549

TEXT OF ENGLISH ABSTRACT: In this paper the problem of the drag acting on a sphere at low speed in slightly rarefied gas flow ($K_n \ll 1$) is considered. In the Knudsen layer the linearized Boltzmann-Krook-Welander equation is solved under the Maxwell-type boundary condition on the wall, and the matched asymptotic expansion solution in the Stokes region is used as the boundary condition at infinity. Solution of flow over a sphere under small K_n is obtained by assuming small temperature difference between the surface and uniform flow. In addition to the rarefaction effect, the inertia effect and reflection model of molecules on the surface are also taken into account, and the sphere drag is expressed as a function of K_n , Re and α (accommodation coefficient).

AUTHOR: HUANG Kezhi [7806 0344 2535]
JIANG Zhixiang [5592 2535 5046]
ZHENG Siliang [6774 1835 2856]

ORG: All of Qinghua University

TITLE: "The Second-order Asymptotic Equations for the Simple Boundary Effect of the Shells"

SOURCE: Beijing LIXUE XUEBAO [ACTA MECHANICA SINICA] in Chinese No 6, 1981
pp 550-561

TEXT OF ENGLISH ABSTRACT: In this paper a second-order approximation theory is presented for the simple boundary effect of thin shells, based on the first-order approximation theory of Rabotnov and Goldenveizer, which is accurate in order of magnitude to within $\sqrt{h/\Lambda}$ only. The second-order approximation theory has the same degree of accuracy as the theory of thin shells itself, based on Kirchhoff's hypothesis. It is pointed out that the "more exact" equations in Goldenveizer's work dealing with the same problem are incomplete in view of the fact that there the first term $w_{\star}(0)$ in the asymptotic series for the "function of intensity" w_{\star} was replaced by its value $w_{\star}(0)|_{\alpha=0}$ on the boundary curve. By use of a simpler method which consists of transformation, i.e., extension, of one of the coordinates α in the direction perpendicular to the boundary curve, the complete second-order asymptotic equations are obtained.

AUTHOR: LIU Diankui [0491 3013 7608]
ZHANG Qihao [1728 0366 3185]

ORG: Both of the Institute of Engineering Mechanics, Chinese Academy of Sciences

TITLE: "Some General Variational Principles for Non-conservative Problems in Theory of Elasticity"

SOURCE: Beijing LIXUE XUEBAO [ACTA MECHANICA SINICA] in Chinese No 6, 1981
pp 562-570

TEXT OF ENGLISH ABSTRACT: In this paper, some variational principles in the theory of elasticity are presented and verified for non-conservative systems by replacing the non-conservative forces with "fellow forces." Due to the non-conservativeness of the fellow forces, the variational principles are expressed in quasi-forms, such as quasi-potential energy principle, quasi-complementary energy principle, generalized quasi-variational principles and quasi-Hamilton principle. Using these quasi-variational principles, some examples, such as buckling loads of rods subjected to non-conservative forces, are calculated.

AUTHOR: WANG Keren [3769 0344 0088]

ORG: Institute of Mechanics, Chinese Academy of Sciences

TITLE: "The Weighting Functions in Fracture Mechanics, Their Generalization and Calculations"

SOURCE: Beijing LIXUE XUEBAO [ACTA MECHANICA SINICA] in Chinese No 6, 1981
pp 571-581

TEXT OF ENGLISH ABSTRACT: Bueckner's weighting functions are discussed in a systematic way and generalized. A weighting function is defined for every coefficient in William's expansions of stress functions at the crack tip and it is also expanded into an eigenfunction. Some relations between the coefficients of that expansion are derived and can be used to calculate weighting functions for specific configurations.

AUTHOR: CHEN Wanji [7115 8001 0679]

ORG: Research Institute of Engineering Mechanics, Dalian Institute of Technology

TITLE: "Generalized Hybrid Element"

SOURCE: Beijing LIXUE XUEBAO [ACTA MECHANICA SINICA] in Chinese No 6, 1981
pp 582-591

TEXT OF ENGLISH ABSTRACT: In the analysis of the finite element method, the variational principle has formed the basis of various models. In this paper, the generalized hybrid element has been established based on the Hu-Washizu principle with relaxed continuity requirements. Existing hybrid elements, for example, stress hybrid element, displacement hybrid element and generalized hybrid stress element, are special forms of the generalized hybrid element.

In this paper, several new kinds of hybrid elements are presented, and criteria for choosing field variables, convergent conditions and rank conditions are also discussed. In addition to general theoretical statements for various kinds of hybrid elements, the formulations of these elements are listed, thus some of the formulations for easy application are given in explicit form.

AUTHOR: RONG Sheng [2837 7105]

ORG: Institute of Mechanics, Chinese Academy of Sciences

TITLE: "The Effect of the Axial Heat Conduction on Dynamic Properties of an AC Arc"

SOURCE: Beijing LIXUE XUEBAO [ACTA MECHANICA SINICA] in Chinese No 6, 1981 pp 592-600

TEXT OF ENGLISH ABSTRACT: The purpose of this paper is to study the effect of axial heat conduction on the dynamic property of an axially symmetric AC arc with a finite length under assumptions that energy transfer by radiation and convection is negligible, and that a simplified linear expression for electrical conductivity can be taken. The nonlinear energy equation is solved by the usual method of separation of variables, a nonlinear transformation and a generalized Laplace transformation, thus yielding an analytical solution for the electric field and the heat flux potential with a given sine current waveform. The solution shows that the dynamic property of an AC arc is determined by two dimensionless parameters in the case when the arc occupies the whole discharge tube. The two parameters are $\omega\theta$ and L , where ω , θ and L denote respectively the frequency of current, the time constant of the arc-tube system and the ratio of the arc length to the arc diameter. The parameter $\omega\theta$ determines mainly the waveform of the electric field and the heat flux potential. The parameter L determines the axial distribution of the electric field and the heat flux potential.

[Continuation of LIXUE XUEBAO No 6, 1981 pp 592-600]

By comparing the above solution with Phillips' result for an infinitely long arc, one can see that the heat flux potential decreases and the electric field increases as a result of axial heat conduction. Axial gradient of the heat flux potential and the electric field appear important, and axial heat conduction has to be taken into account in the case that the arc length is finite. The result of this paper leads to Phillips' solution when the arc length approaches infinity. From the results calculated for some typical parameters one can see that when L is more than 5, the effect of the axial heat conduction on the dynamic property of an AC arc is negligible.

AUTHOR: MA Tengcai [7456 7506 2088]
GONG Ye [1362 6851]

ORG: Both of the Southwestern Institute of Physics, PRC

TITLE: "Numerical Analysis of Effects of Cold Plasma Layer on Instabilities in Tokamak Devices"

SOURCE: Beijing LIXUE XUEBAO [ACTA MECHANICA SINICA] in Chinese No 6, 1981 pp 601-610

TEXT OF ENGLISH ABSTRACT: An improved linearized theoretical model has been developed for studying effects of cold plasma layer on instabilities. MHD perturbation equations with arbitrary conductivity at plasma edge are derived. As a result the effects of temperature and density on the growth rate are obtained which reflect the main characteristics of the present Tokamak experiments. In the present work the cold-plasma edge plays a fundamental role, being directly responsible for the rapid growth of tearing modes through the introduction of a destabilizing effect. The surface kink instabilities of the modes 3/1, 2/1 and 3/2 are excited gradually one-by-one due to the increased cooling of the outer plasma region. Their growth rates can develop from the growth rates of tearing modes to those of free boundary kink modes, in accordance with the temperature and density of plasma at the boundary. As the temperature at the outer edge increases, the stable "window" will become wider and wider. Decreasing relative

[Continuation of LIXUE XUEBAO No 6, 1981 pp 601-610]

density n_c of the outer region will lead to a deteriorated situation for confinement. As $n_c \leq 10^{-3}$, there no longer exists a stable "window."

In view of the above reasons, the present work does provide a possible physical explanation of the major disruption. When the $m = 2$ island makes contact either with the limiter or an outer region of cold plasma, a disruption is initiated.

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TITLE: "Laboratory Modeling of Topographic Effects on the Oceanic Current"

SOURCE: Beijing LIXUE XUEBAO [ACTA MECHANICA SINICA] in Chinese No 6, 1981
pp 611-618

TEXT OF ENGLISH ABSTRACT: Topographic effects on fluid flow in a rotating frame differ remarkably from those in an inertial frame due to the action of Coriolis force. Recently, much effort of geophysical fluid dynamics research has been directed toward this problem.

In this report some elementary modeling experiments for topographic effects on rotating fluid flow carried out in the Institute of Mechanics are presented. Main topographies adopted include shelf, ridge, island-like obstacle and depth change in radial direction. These are considered important (though greatly simplified) in China's seas. The experiments were performed in a pie-shaped tank using the "source'sink" method. Results obtained seem encouraging for modeling large-scale characteristics of oceanic circulation by means of laboratory produced homogeneous rotating fluid systems.

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TITLE: "Transonic Test on the Ballistic Range"

SOURCE: Beijing LIXUE XUEBAO [ACTA MECHANICA SINICA] in Chinese No 6, 1981
pp 619-625

TEXT OF ENGLISH ABSTRACT: New methods of transonic experimentation in the ballistic range are presented in this paper. Two special launching techniques are used on a two-stage light gas gun, namely the filling gas techniques which can be used to obtain a projectile velocity in the subsonic range and the low filling condition technique which can be used to reach transonic and supersonic ranges. Since initial acceleration of the model is lower in the subsonic and transonic cases, models can be launched with stable attitude and undamaged configuration. In addition, there is no support and small wall effect, so that the ballistic range has special advantages for the transonic test. Using the above-mentioned techniques, clear photographs of flow field around spheres in transonic cases have been obtained. Compared with supersonic and hypersonic cases, the stand-off distance of shock waves, the neck width, the position of separation point and the wake are

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obviously quite different. Two photographs of flow field around a sphere at $M = 1.01$ and $M = 0.99$ have been obtained and produced valuable information. Finally a tentative idea for raising the Reynolds number up to 10 by increasing pressure and decreasing temperature in the range is described.

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TITLE: "Stress Calculation of Elasto-dynamics"

SOURCE: Beijing LIXUE XUEBAO [ACTA MECHANICA SINICA] in Chinese No 6, 1981
pp 626-628

TEXT OF ENGLISH ABSTRACT: In this paper, we state that the conservation scheme of elasto-dynamics is just a kind of finite element method with integral approximation. On a regular mesh's internal points it is the same as the difference method. In addition, a new computing art of stress is used. With the same mesh conditions, the stress solution not only satisfies the dynamic equations of motion in a small area, but its precision is also higher than that of the finite element method.

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TITLE: "Theoretical Explanation of Arresting the Softening of A-15 V₃Si in Superconducting State"

SOURCE: Beijing DIWEN WULI [ACTA PHYSICA TEMPERATURAE HUMILIS SINICA] in Chinese No 4, 1981 pp 267-275

TEXT OF ENGLISH ABSTRACT: The Hamiltonian which was found by us in 1977 is extended to include the lattice anharmonicity. We calculate the Green's functions of the shear phonon propagating along the [110] direction with [110] polarization in normal and superconducting states and obtain the elastic modulus $C_{11}(T)-C_{12}(T)$ associated with this acoustic branch. The theoretical curve of $C_{11}(T)-C_{12}(T) \sim T$ can be adjusted to satisfy experiments in all low temperature regions, including $T > T_c$ and $T < T_c$ for A-15 compound V₃Si. It can be explained that the onset of superconductivity abruptly arrests the softening and maintains the modulus at a constant.

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TITLE: "Critical Temperature of Strong-coupled Superconductors"

SOURCE: Beijing DIWEN WULI [ACTA PHYSICA TEMPERATURAE HUMILIS SINICA] in Chinese No 4, 1981 pp 276-284

TEXT OF ENGLISH ABSTRACT: The present paper, making use of a more realistic energy gap model,

$$\text{Re}[\Delta(\omega)] = \begin{cases} \Delta_0[1 + 2B\alpha^2(\omega)F(\omega)] & \omega < \omega_0, \\ -\Delta_0 & \omega > \omega_0, \end{cases}$$

solved an Eliashberg's energy gap integral equation at $T = T_c$, and derived an expression of critical temperature of strong-coupled superconductors

$$T_c = 1.97\omega_0 \exp\left\{-\frac{1 + 1.276\lambda + r}{\lambda - \mu^*(1 + 0.5\lambda)}\right\}.$$

It has been calculated that metallic hydrogen as $T_c = 178$ k at zero pressure.

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TITLE: "The Experiments on Electromagnetic Shielding Properties of a Small Metal Dewar"

SOURCE: Beijing DIWEN WULI [ACTA PHYSICA TEMPERATURAE HUMILIS SINICA] in Chinese
No 4, 1981 pp 285-289

TEXT OF ENGLISH ABSTRACT: In this paper we report the experimental results of electromagnetic shielding properties of a kind of small metal dewar. The dewar's container is four liters with a hold time of about 24 hours. It possesses electric shielding properties and shielding ability for an AC magnetic field of more than 50 Hz. It is suitable for Josephson devices and other superconducting devices.

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TITLE: "A Study of the Cu-CuNi-NbTi Three-component Multi-filamentary Superconducting Composite for a Pulsed Magnet"

SOURCE: Beijing DIWEN WULI [ACTA PHYSICA TEMPERATURAE HUMILIS SINICA] in Chinese
No 4, 1981 pp 290-300

TEXT OF ENGLISH ABSTRACT: From the viewpoint of stability and ac loss, the design method of the main parameters (filament diameter d , composite diameter D and twist pitch ℓ_p) of the multi-filamentary superconducting composite for a pulsed magnet is described. Applying this method, two kinds of Cu-CuNi-NbTi three-component multi-filamentary composites, of which the average transverse effective resistivities of matrix and NbTi filament diameters are about $2 \times 10^{-6} \Omega \cdot \text{cm}$, $10 \mu\text{m}$ and $2 \times 10^{-7} \Omega \cdot \text{cm}$, $6 \mu\text{m}$ respectively, have been successfully fabricated. The effects of the metallurgical processing, especially the effect of extruding temperature on the drawing of such extra-fine NbTi filaments, are discussed. J_c of short samples of the composites and the exciting properties of the small magnets of such composites are also reported.

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TITLE: "The Behavior of Superconducting Magnet Wound by Three Component Composite
under High-speed Exciting"

SOURCE: Beijing DIWEN WULI [ACTA PHYSICA TEMPERATURAE HUMILIS SINICA] in Chinese
No 4, 1981 pp 301-305

TEXT OF ENGLISH ABSTRACT: The characteristics of superconducting magnet wound by
the China-made multi-filamentary Nb-Ti-Cu-Cu-Ni three component composite under
high-speed exciting have been studied with the method of forced exciting and
sudden-switch-on when the current rating was given. The maximal exciting rate,
under which the critical current of the magnet did not show obvious degradation,
was obtained. Suggestions for improving the stability of the material were given.

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TITLE: "High Precision Power Supply for Superconducting Magnet"

SOURCE: Beijing DIWEN WULI [ACTA PHYSICA TEMPERATURAE HUMILIS SINICA] in Chinese
No 4, 1981 pp 306-315

TEXT OF ENGLISH ABSTRACT: This paper gives a description of how to develop a high
precision power supply for a superconducting magnet. It principally analyzes its
stability, automatic transformation between the stabilized voltage and current and
protection against quenching. The paper also presents the measures for improving
the stability of the device.

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TITLE: "Experiences in Developing Protective Device for Superconducting Magnet"

SOURCE: Beijing DIWEN WULI [ACTA PHYSICA TEMPERATURAE HUMILIS SINICA] in Chinese No 4, 1981 pp 316-324

TEXT OF ENGLISH ABSTRACT: In this paper, a protective device which has been developed by us is introduced. The requirements of the switch, when the magnet quenches and discharges through a linear resistor, are described, and the efficiency of energy transfer is calculated and measured. A protective method for superconducting magnets which are wound with conductors of different cross section is given.

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TITLE: "Experimental Investigation of Wax-filled Superconducting Solenoids"

SOURCE: Beijing DIWEN WULI [ACTA PHYSICA TEMPERATURAE HUMILIS SINICA] in Chinese No 4, 1981 pp 325-333

TEXT OF ENGLISH ABSTRACT: The experimental results of about 50 wax-filled superconducting solenoids are summarized. These experiments have proved that high current density wax-filled solenoids can reach or approach short-sample performance. After many room temperature-liquid nitrogen temperature thermal cycles, the performance of the magnet is stable. The influence of different kinds of technology of wax filling on the performance of the magnet has been investigated. The largest tested magnet has a bore diameter of 400 mm, stored energy about 0.3 MJ. Its maximal field is about 5.2 T, current density of NbTi superconductor is 9×10^4 a/cm² and overall current density is about 2.2×10^4 a/cm².

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TITLE: "A Study of Thermal-conductivity Measurement of Insulating Material at Low Temperatures"

SOURCE: Beijing DIWEN WULI [ACTA PHYSICA TEMPERATURAE HUMILIS SINICA] in Chinese No 4, 1981 pp 334-339

TEXT OF ENGLISH ABSTRACT: The factors appearing in thermal-conductivity measurement at low temperatures have been analyzed in this paper. A flat-plate thermal-conductivity apparatus for liquid hydrogen temperature has been developed.

After repeated experiments, a new assembling method and experiment method are suggested. The problems that were not solved in J. F. Haskin's paper are solved. Finally, measured results of thermal-conductivity (20-280 K) of polyurethane foam are given.

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TITLE: "A Study on the Relationship between the Low Temperature Impact Toughness and Fracture Mode of the Low-carbon High-manganese Cast Steels"

SOURCE: Beijing DIWEN WULI [ACTA PHYSICA TEMPERATURAE HUMILIS SINICA] in Chinese No 4, 1981 pp 340-346

TEXT OF ENGLISH ABSTRACT: In this paper, the relation between the low-temperature impact toughness and fracture mode of the low-carbon high-manganese cast steels is studied. Experimental results show that the fracture of these cast steels is essentially of the transgranular tough fracture mode, while it appears essentially as the intergranular mode at -196°C. There are certain correlations between the impact values, sizes of dimples and testing temperatures: the impact values are higher and the dimples are bigger and deeper at room temperature than those at cryogenic temperatures. It has also been found that the non-metallic inclusions have remarkable effects on the dimensions of the dimples.

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TITLE: "Development of X-band Superconducting Niobium Cavity"

SOURCE: Beijing DIWEN WULI [ACTA PHYSICA TEMPERATURAE HUMILIS SINICA] in Chinese
No 4, 1981 pp 347-350

TEXT OF ENGLISH ABSTRACT: The structure design, cavity preparation and measurement method of loaded Q of an X-band TE_{011} mode superconducting Nb cavity have been described. Through machining, chemical and electrolytic polishing, but without UHV high temperature degassing, 4.2×10^7 of loaded Q at 4.2 K, and 2.0×10^8 at 2K, have been obtained.

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TITLE: "AC Loss Comparison of NbTi-Cu and NbTi-Cu-CuNi Superconducting Composite Magnets"

SOURCE: Beijing DIWEN WULI [ACTA PHYSICA TEMPERATURAE HUMILIS SINICA] in Chinese
No 4, 1981 pp 351-355

TEXT OF ENGLISH ABSTRACT: AC losses of NbTi-Cu and NbTi-Cu-CuNi superconducting composite magnets have been measured by means of electronic integral technique. The experimental results are presented and their qualitative comparison is made. It is shown within our experiment range that:

- (1) AC losses of NbTi-Cu composite magnet are proportional to the peak value and exciting velocity of the magnetic field;
- (2) AC losses of NbTi-Cu-CuNi composite magnet are also proportional to the peak value of the magnetic field, but decrease as exciting velocity increases.

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TITLE: "A Concise Equivalent Circuit Representation of the Nonhysteretic RF-SQUID"

SOURCE: Beijing DIWEN WULI [ACTA PHYSICA TEMPERATURAE HUMILIS SINICA] in Chinese No 4, 1981 pp 356-360

TEXT OF ENGLISH ABSTRACT: An equivalent circuit representation of the nonhysteretic RF-SQUID operating at low frequency excitation ($\omega \leq 10^8/\text{sec}$), including the influence of the pair-quasiparticle interference current term, is derived in a simple way. Its analytic formulations are very concise and convenient for application.

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TITLE: "An Idea for Improving the Critical Current Density of Nb_3Sn "

SOURCE: Beijing DIWEN WULI [ACTA PHYSICA TEMPERATURAE HUMILIS SINICA] in Chinese No 4, 1981 pp 361-362

TEXT OF ENGLISH ABSTRACT: Since a peak value in the relationship, which is the same as that predicted in 1973 by the author for the NbTi44 alloy, between the J_c and grain size has also been found in the Nb_3Sn compound, an idea for improving the J_c of Nb_3Sn is suggested. That is, in addition to matching the grain size of Nb_3Sn with the flux lattice parameter, the flux pinning strength of the Nb_3Sn grain boundary should be as large as possible.

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